35. *On two* Chimæroid Jaws *from the* Lower Greensand *of* New Zealand. By E. Tulley Newton, Esq., F.G.S., of H.M. Geological Survey. (Read June 7, 1876.)

(By permission of the Director-General of H.M. Geological Survey.)

[Plate XXI.]

Having been working for some time past at the Cretaceous Fishes, my interest has been especially centred in the group of the Edaphodontidæ; for the specimens belonging to this group, which have been brought to light within the last few years, have much enlarged our knowledge of these peculiar forms of fossil fishes. The general results of my examination of this group, will shortly be published; and in the present communication it is only proposed to consider two specimens from the Lower Greensand of New Zealand, which have been deposited in the British Museum by Dr. Hector. My attention was first directed to these specimens by Mr. W. Davies, of the British Museum, when I was examining the fine series of Chimæroid jaws now in the national collection.

One of these New-Zealand specimens is the right mandible of a species of *Ischyodus* already known to us from the Gault of Folkestone; and the second is a small right maxilla, which is altogether new and appears to be generically distinct from any of the fossil forms hitherto described.

Before considering the peculiarities of the mandible, it will be necessary to enter into some explanation and description of the species to which it is referred.

It appears that the late Prof. Agassiz, some years ago, saw in the Earl of Enniskillen's collection of fossil fishes, a Chimæroid mandible from the Gault of Folkestone, which he named, in manuscript, *Chimæra brevirostris*. Subsequently, in his 'Poissons Fossiles' (1843)*, he alluded to this specimen under the same specific name, placing it in his subgenus *Ischyodon* †; but, most unfortunately, he gave no description or figures. Since the publication of that standard work of fossil ichthyology, several examples of *Ischyodus*-mandibles have been obtained from the Gault, nearly all of which appear to belong to one species. These mandibles have generally been referred to Agassiz's *I. brevirostris*, simply because they were the only forms of *Ischyodus* known from the Gault; but the want of a figure or description of the original specimen left the matter in great uncertainty.

At the request of my colleague, Mr. Etheridge, the Earl of Enniskillen has very kindly sent the original type specimen of Agassiz's *I. brevirostris* to the Museum of Practical Geology for examination and comparison; and I am now therefore enabled to give for the first time a figure of the type of this species (Pl. XXI. fig. 4). Although the specimen is much broken, there can be no doubt of its specific identity with those mandibles which have been more recently obtained from the same horizon, and in a more perfect condition.

---

* Recherches sur les Poissons Fossiles, iii. p. 344.

† Agassiz provisionally adopted Sir Philip Egerton's genus *Ischyodus*, with the above modification.

Among the fish-remains from the Cambridge phosphatic deposits, examples of *I. brevirostris* (which can now be definitely determined to be this species) are not uncommon; and one of the varieties there found agrees very closely, not only with the type specimen from the Gault of Folkestone, but also with the New-Zealand Lower-Greensand example, which forms, in part, the subject of the present communication.

As *I. brevirostris* has never been described, it is proposed here to give the chief peculiarities of the mandible; and considering the fragmentary character of the type specimen, it is thought better to describe a more perfect example, and afterwards to compare with this, first the original type specimen, and then the one from New Zealand.

Good evidence of the form of the maxilla and præmaxilla of *I. brevirostris* has now been obtained; but as these parts are not required here for comparison, I do not purpose describing them.

ISCHYODUS BREVIROSTRIS, Agassiz. (Plate XXI. figs. 1–5.)

The specimen of a right mandible, represented by fig. 1, has been chosen for description on account of its being extremely like Agassiz's type specimen, and also because it is intermediate in form between two or three extreme varieties, this species being, like others of the family, very variable in form. The general appearance of the jaw will be best understood by a reference to the figure. It is somewhat more triangular in outline than is usually the case in this genus, or even in other specimens of the present species. The oral margin (*a* to *d*) is seen to be deeply indented anteriorly and posteriorly. The front or symphysial margin is slightly convex. The posterior margin is irregular in outline, being always more or less broken. It is evident from the form of these jaws, that they were continually growing at the hinder part, and being thrust forward as the anterior portions were worn away; from this arrangement it is obvious that at the hinder part the bone would be only imperfectly ossified, and consequently easily broken; and as a matter of fact the hinder part of these fossils is always more or less broken.

Viewed from the inner side, as in fig. 1, the oral surface (*os*) of this mandible is seen to be armed with five of those peculiar dentinal surfaces which have been sometimes termed *tritors*, but which will be alluded to in this paper as teeth (fig. 1, *a b c d e*). The first of these is placed at the end of the beak (*a*). The dentinal substance of which this is composed is arranged in a series of plates or lamellæ, set somewhat obliquely to the anterior border. These lamellæ are not seen in fig. 1; but in specimens with the outer surface denuded they are seen to extend along near the front margin as in fig. 2. The dentinal substance of which the other four teeth are composed is not arranged in lamellæ, but each tooth consists of a number of tubes (filled with dark substance), generally set perpendicularly to the surface, around which the dentinal substance is deposited. A surface-view of a portion of one of these tubular teeth is shown in fig. 3. The tooth *b* (fig. 1) is small, and placed at the anterior end of the upper margin of the symphysis. The tooth near the letter *c* causes the projection upon the oral margin, and extends inwards almost to the large central one, *e*. The posterior and outer tooth, *d*, extends for some little distance near to the margin of the bone. The median tooth, *e*, is much larger than either of the others; in this species there is always a space between it and the symphysial tooth, *b*. Below and behind the teeth the bone is covered by a delicate layer of enamel-like substance, which is smooth and shining and shows definite lines of growth. The symphysial surface (*sy*) is slightly convex; but towards its oral margin it is marked by a deep groove with a rounded and projecting ridge immediately above it.

If Agassiz's type specimen (fig. 4) be compared with the more perfect one described above (fig. 1), the close resemblance in every particular will, I think, be obvious, the greatest difference being that the middle tooth (*e*) is larger in the type (fig. 4); this difference, however, must be regarded as of little importance, as it is almost wholly due to the fact that the bony covering is more broken away in the latter.

It might be thought that the differences in general outline and in the form of the teeth between the two specimens represented by figs. 1 and 4 would justify their being referred to different species; but the examination of a large series from the Gault and Cambridge deposits has convinced me that *I. brevirostris* varies to a far greater extent than is shown in these two specimens. In some instances the tooth *e* is narrower than it is in fig. 1, and extends almost to the oral margin at *c*; in other cases the same tooth will be proportionally much wider, and placed further back. The extent to which the oral margin is indented also varies much, being sometimes more, and sometimes less than in fig. 1. The proportional length of the oral margin from *a* to *d* likewise varies.

The New-Zealand specimen (fig. 5) has the outer surface imbedded in the matrix, and a portion of the beak broken off; but still the fossil is sufficiently perfect to allow of a very close comparison. The description of the Cambridge mandible given above would answer equally well for this one from the Antipodes; but a comparison of the two (figs. 1 & 5) will show that there are some differences. When, however, the variations which are known to occur among the Gault specimens belonging to this species are duly considered, these differences will be regarded as of minor importance. The greatest dissimilarities are these: in the New-Zealand specimen the oral margin was probably shorter and less indented, the margin from *d* to *x* is proportionally longer, and the middle tooth *e* is larger, and extends further forward and nearer to the symphysial tooth, *b*. If now the figs. 1, 4, & 5 be compared, it will, I think, be acknowledged that there is as great a difference between the Cambridge and the Folkestone specimens (figs. 1 & 4) as there is between the New-Zealand form (fig. 5) and the original type specimen of *I. brevirostris* (fig. 4).

CALLORHYNCHUS* HECTORI, nov. sp. (Pl. XXI. figs. 6–9.)

The second Chimæroid jaw, alluded to above as having been brought from New Zealand by Dr. Hector, is a small right maxilla which presents certain peculiar and interesting characters.

This maxilla measures little more than an inch in length, and not more than three fourths of an inch in width at its widest part. The oral surface of the specimen is exposed, the upper portion being imbedded in the matrix. The entire bone is much depressed, as shown in figs. 8 & 9; and this is evidently its natural form, for there is not the slightest evidence of its having been distorted in the process of fossilization. It is narrowest in front, and widens out at the hinder part, the outer angle being produced backwards, downwards, and outwards, so as to form a conspicuous process. The oral surface is provided with but one tooth, composed of the tubular kind of dentinal substance; this one, however, has a peculiar form. Posteriorly the tooth appears to pass into the substance of the bone, as in the other forms of the Edaphodontidæ; and at this part it is proportionally wide, occupying the greater part of the width of the bone; passing forwards it is seen, at a distance of about $\frac{1}{4}$ of an inch from its hinder border, to separate into two processes: one of these passes along the inner side near the symphysis, almost to the anterior end of the maxilla; the other extends along the outer margin for some little distance, but does not reach so far forward as the inner one. Between these two processes there is a depressed space, the inner process standing up in relief as a rounded ridge. Both sides of each of these processes appear to have been worn by attrition against the teeth of the mandible. Judging from the manner in which this maxillary tooth is worn, it seems at first sight that there must have been at least three teeth in the mandible—one to cut out the central groove in the maxillary tooth, and a second and a third to wear away the inner and the outer sides. But a study of the recent *Callorhynchus* shows that the mandible was probably provided with but one tooth.

It will be remembered that the maxilla of *Edaphodon* is characterized by three teeth, that of *Ischyodus* by four, and that of *Elasmodus* by possessing two elongated teeth and a series of dental laminæ upon the outer margin. In the young condition it appears that the two long teeth are joined posteriorly and rolled in a peculiar scroll-like manner. In general appearance this tooth resembles that of the New-Zealand maxilla (compare Pl. XXI. fig. 6 with

---

* When the paper was read before the Society, this specimen was described as the type of a new genus under the name of *Upsilodus*; but some remarks made by the referee induced me to reexamine the matter. Through the kindness of Dr. Günther, I have had the advantage of studying the recent *Callorhynchus antarcticus*, and have convinced myself that there are no such important differences between its maxilla and this fossil as, from descriptions alone, I had supposed to exist. I have therefore felt compelled to refer the fossil maxilla to *Callorhynchus*.

Geol. Surv. Dec. 6, pl. i. fig. 8); but this resemblance is more apparent than real.

Concerning the maxilla of *Ganodus*, one would like to be better informed. Agassiz says ('Poissons Fossiles,' vol. iii. p. 339) "that the upper jaw of this genus resembles that of *Callorhynchus*; but its external face, in place of being entirely concave, presents only a deep groove along the external part, and the remainder is convex." The New-Zealand specimen does not agree with this description, nor with the figures which are given. Concerning the mandibular teeth Agassiz goes on to say that they are near together and united into a protuberance covered by a bony layer, and that they are placed so obliquely as to be parallel with the dentary margin.

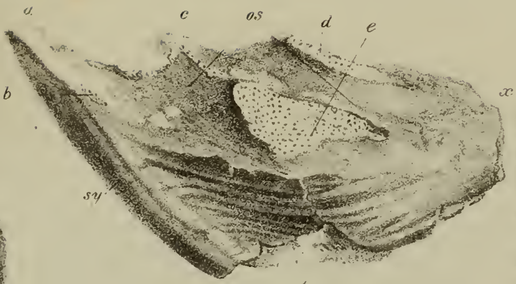
From these considerations, I think it will be obvious that the New-Zealand specimen cannot be referred to either *Ischyodus*, *Edaphodon*, or *Elasmodus*, and also that we should not be justified in placing it in the genus *Ganodus*; for it seems extremely improbable that teeth placed obliquely in the mandible should wear a single maxillary tooth into longitudinal grooves.

A comparison of the New-Zealand specimen with the maxilla of *Callorhynchus antarcticus* shows that, although there are minor differences, yet in all their chief points they are remarkably alike. Their general form and size closely agree. In both there is but a single tooth, forked anteriorly and covered by the bone posteriorly. The greatest differences between the two are these: the tooth of the New-Zealand maxilla is flatter, larger, and has longer anterior processes than that of *C. antarcticus*, the tooth of the latter being more rounded and not approaching so nearly to the borders of the bone, while the anterior portion is much less deeply indented.

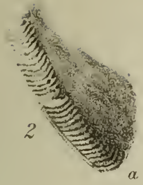
Each mandible of *C. antarcticus* possesses but one tooth; and it is this which cuts out the indentation in the front of the maxillary tooth, thus forming the two processes. The outer margin of the mandible, although not armed with teeth, is trenchant and wears away the outer surfaces of the maxillary bone and tooth. The inner or symphysial edge of the maxillary tooth stands above the surface of the bone, so that when the two maxillæ are together there is a groove between the teeth. This conformation is markedly shown in the New-Zealand maxilla.

The differences above-mentioned between the maxilla of *C. antarcticus* and the New-Zealand fossil are of such a character that they can scarcely be regarded as of more than specific value; and it is suggested that the name of the Director-General of the New-Zealand Survey, who brought the specimen to this country, should be associated with it as a specific appellation, and that this Chimæroid fish should be known as *Callorhynchus Hectori*.

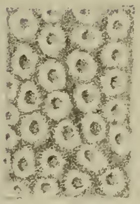
With regard to the geological horizon from which the two specimens constituting the subject of the present communication were derived, the only information I have been able to obtain is, that they were found, together with other fish remains, imbedded in a fine conglomerate, believed to be of Lower Greensand age, which occurs at Amuri Bluff, New Zealand.



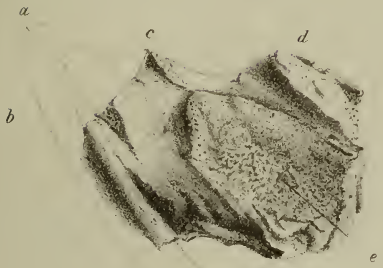
1



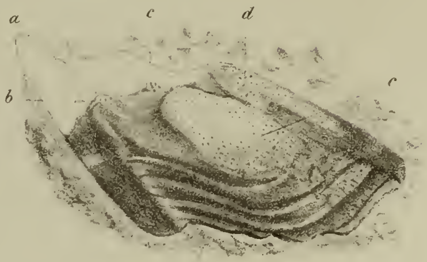
2



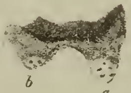
3 x 6



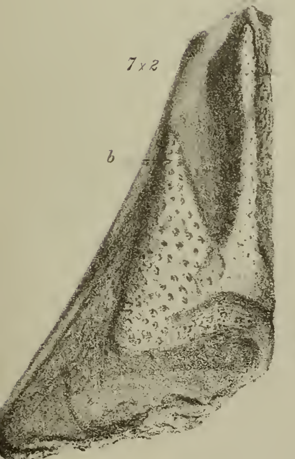
4



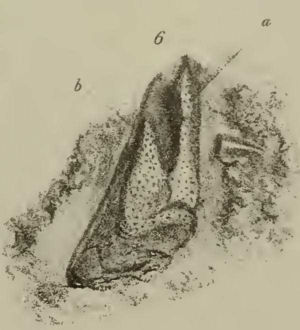
5



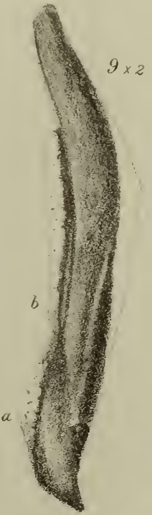
8 x 2



7 x 2



6



9 x 2

Sharman ad nat del et lith.

M&N.Hanhart imp

CRETACEOUS CHIMÆROIDS

DESCRIPTION OF PLATE XXI.

ISCHYODUS BREVIROSTRIS, Ag. Figs. 1–5.

Fig. 1. A right mandible, from the Cambridge phosphatic deposits, seen from the inner side: *a*, laminated tooth at extremity of beak; *b*, symphysial tooth of tubular dentine; *c*, anterior and outer tooth of tubular dentine; *d*, posterior and outer tooth of tubular dentine; *e*, median tooth of tubular dentine; *os*, oral surface; *sy*, symphysial surface; *x*, posterior angle. In the Museum of Practical Geology.

Fig. 2. A portion of the beak of a left mandible from Cambridge, having the outer surface ground away to show the laminated structure of the tooth. In the Museum of Practical Geology.

Fig. 3. A portion of the surface of one of the tubular teeth, enlarged six diameters, showing the central tubes and the surrounding dentine. In the Museum of Practical Geology.

Fig. 4. A right mandible from the Gault of Folkestone. The original type of the species alluded to in Agassiz's 'Poissons Fossiles,' iii. p. 344. In the collection of the Earl of Enniskillen. Letters as in fig. 1.

Fig. 5. A right mandible from the Lower Greensand of New Zealand. In the British Museum. Letters as in fig. 1.

CALLORHYNCHUS HECTORI, sp. nov. Figs. 6–9.

Fig. 6. A right maxilla from the Lower Greensand of New Zealand, showing the lower or oral surface: *a*, the inner spur of the tooth; *b*, the outer spur of the tooth. In the British Museum.

Fig. 7. Same specimen, enlarged.

Fig. 8. Same specimen, enlarged, front view.

Fig. 9. ,, ,, outer side.

DISCUSSION.

Mr. ETHERIDGE stated that he had been called upon to examine carefully the large series of fossils brought from New Zealand by Dr. Hector, and that he had been much struck with those associated with the specimen of *Ischyodus* noticed by Mr. Newton. These were undoubtedly of Cretaceous type; and the deposit, in its general conditions, appeared closely to resemble the remarkable beds of Upware and Farringdon. Mr. Newton's paper was of great importance, as throwing much light upon the distribution in time and space of so interesting and remarkable a group as the Chimæroid fishes.

Sir PHILIP EGERTON was gratified to find that the divisions established by him in this group of fishes some twenty years ago still held good. Mr. Newton's determination of the *Ischyodus* was certainly of great interest, as demonstrating the occurrence in New Zealand of a species belonging to our own Greensand.

The AUTHOR stated that the nearest ally of his new form appeared to be the living *Callorhynchus*. The maxilla was remarkably well preserved; and its single tooth seemed to furnish evidence of the existence of three teeth in the lower jaw.